

CLAIMS

What is claimed is:

1 1. A semiconductor laser, comprising:
2 a first optical gain element that generates a first
3 light beam having a first optical frequency;
4 a second optical gain element that generates a second
5 light beam having a second optical frequency;
6 a nonlinear optical element to create a polarization
7 wave having a third optical frequency; and,
8 a plurality of electrical contacts that generate a
9 spatially alternating electric field that phase matches the
10 polarization wave to a third light beam having the third
11 optical frequency.

1 2. The laser of claim 1, wherein the third optical
2 frequency is in a range from the Infrared to the THz
3 regions.

1 3. The laser of claim 1, wherein said electrodes have
2 opposite polarities.

1 4. The laser of claim 1, wherein said nonlinear
2 optical element includes a waveguide optically coupled to
3 said first and second gain elements.

1 5. The laser of claim 1, further comprising a
2 diffraction grating tuned to the third optical frequency of
3 the third light beam.

1 6. The laser of claim 1, wherein the semiconductor
2 laser is fabricated with group III-V material.

1 7. The laser of claim 6, wherein the spatially
2 alternating electric field modulates a nonlinear
3 susceptibility of the group III-V material.

1 8. A semiconductor laser, comprising:
2 gain means for generating a first light beam having a
3 first frequency and a second light beam having a second
4 frequency;
5 mixing means for creating a polarization wave having a
6 third optical frequency; and,

7 matching means for generating a spatially alternating
8 electric field and phase matching the polarization wave to
9 a third light beam at the third optical frequency.

1 9. The laser of claim 8, wherein the third frequency
2 is in a range from the Infrared to the THz regions.

1 10. The laser of claim 8, wherein said matching means
2 includes a plurality of electrodes that have opposite
3 polarities.

1 11. The laser of claim 8, wherein said mixing means
2 includes a waveguide.

1 12. The laser of claim 8, further comprising a
2 diffraction grating tuned to the third optical frequency of
3 the third light beam.

1 13. The laser of claim 8, wherein the semiconductor
2 laser is fabricated with group III-V material.

1 14. The laser of claim 13, wherein the spatially
2 alternating electric field modulates a nonlinear
3 susceptibility of the group III-V material.

1 15. A method for operating a semiconductor laser,
2 comprising:
3 generating a first light beam having a first frequency;
4 generating a second light beam having a second
5 frequency;
6 mixing the two beams to generate polarization wave
7 having a third optical frequency, and,
8 generating a spatially varying electrostatic field that
9 phase matches the polarization wave to a third light beam
10 with the third optical frequency.

1 16. The method of claim 15, wherein the third optical
2 frequency is in a frequency from the Infrared to the THz
3 regions.

1 17. The method of claim 15, wherein the first and
2 second light beams travel along a waveguide.

1 18. The method of claim 15, wherein the spatially
2 alternating electric field is generated by a plurality of
3 electrodes having opposite polarities.

1 19. The method of claim 15, wherein the spatially
2 alternating electric field modulates a nonlinear
3 susceptibility of a material of the semiconductor laser.

1 20. A semiconductor laser, comprising:
2 a first optical gain element that generates a first
3 light beam having a first frequency;
4 a nonlinear optical element to create a polarization
5 having a second optical frequency and a third optical
6 frequency by optical parametric oscillation; and,
7 a plurality of electrical contacts that generate a
8 spatially alternating field that phase matches the
9 polarization wave to the third optical frequency.

1 21. The laser of claim 20, wherein the third optical
2 frequency is in a range from the Infrared to the THz
3 regions.

1 22. The laser of claim 20, wherein said electrodes
2 have opposite polarities.

1 23. The laser of claim 20, wherein said nonlinear
2 optical element includes a waveguide optically coupled to
3 said first and second gain elements.

1 24. The laser of claim 20, further comprising a
2 diffraction grating tuned to the third optical frequency of
3 the third light beam.

1 25. The laser of claim 20, wherein the semiconductor
2 laser is fabricated with group III-V material.

1 26. The laser of claim 20, wherein the spatially
2 alternating electric field modulates a nonlinear
3 susceptibility of the group III-V material.